Synthesis of Magnetic Graphene Oxide Nanofluid and its Evaluation as a Modifier of Rock-Fluid Interfacial Properties in EOR

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Abstract

In oil reservoirs, some rock-fluid systems exhibit high wettability towards oil. This impedes the flow of oil through the reservoir pores, reducing the recovery factor and increasing operational costs [1]. For this reason, in this work, an aqueous nanofluid was synthesized from magnetite nanoparticles supported on graphene oxide (Fe_3O_4@GO), which were obtained by means of partial oxidation of Fe^{+2} with KNO_3 in presence of graphene oxide; confirming its synthesis through XRD, SEM, FTIR DLS, and UV-Vis [2]. Subsequently, its effect on the nanofluid-oil interfacial tension was evaluated, with a decrease of up to 10% compared to water-oil interfacial tension. Likewise, the alteration of the wettability of an outcrop rock sample (water contact angle ~67°) was determined. After immersion in Fe_3O_4@GO nanofluids (500 ppm) for a period of 30 minutes, an increase in its water wettability was established, reflected in a decrease in the contact angle. Values of up to ~40° were reported, making the rock more hydrophilic due to the deposition of a layer of Fe_3O_4@GO (figure 1) [3]. The results obtained led to the conclusion that the use of this composite nanomaterial significantly improves reservoir conditions for crude oil exploitation, which could result in an increase in the recovery factor.

References

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[2] Almahfood, M. and Bai, B. The synergistic effects of nanoparticle-surfactant nanofluids in EOR applications, J Pet Sci Eng, vol. 171, no. March, pp (2018) 196–210.
[3] Eltoum, H., Yang, Y. L., & Hou, J. R. (2020). The effect of nanoparticles on reservoir wettability alteration: a critical review. Petroleum Science, 18(1) (2020) 136–153.

Figures

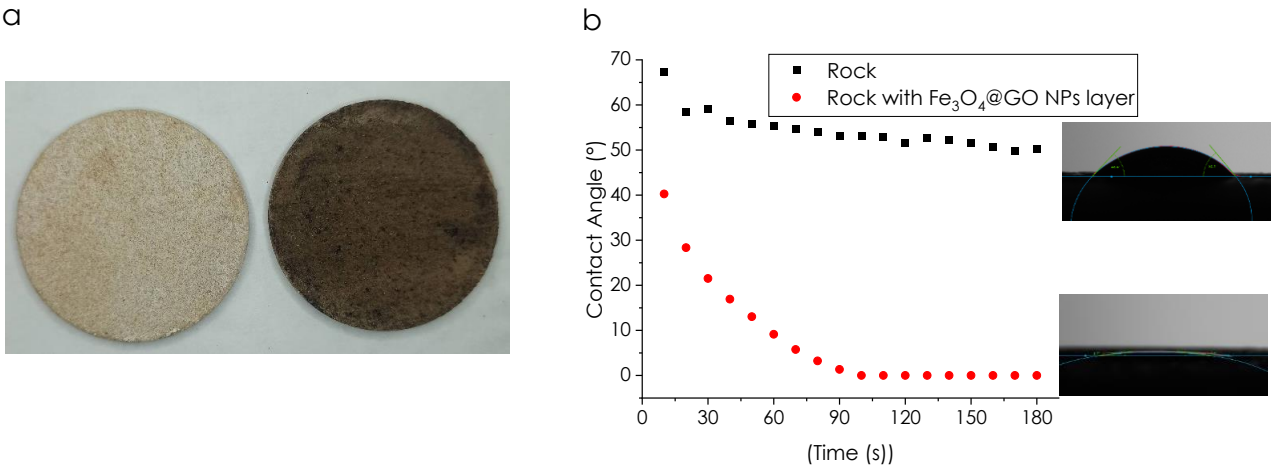

Figure 1: a) Outcrop rock samples for contact angle measurement, Outcrop rock before(left) and after (right) of the immersion in Fe3O4@GO nanofluid. b) Contact angle result on outcrop rock sample and outcrop rock with Fe_3O_4@GO layer).